

Magnets, motors, generators and transformers

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab

Name: _____ Date: _____ Class: _____

Does a real transformer follow the turns-ratio rule, and how much energy does it lose? In this lab you change the primary voltage of a demountable transformer, measure the secondary voltage and compare it with the voltage predicted from the numbers of turns. It takes about 30 minutes.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS2-5, GCSE P7

Aim

To test whether the voltages across the two coils of a transformer follow the turns-ratio rule $V_p \div V_s = N_p \div N_s$, and to see how close a real transformer gets to the ideal.

Equipment

- demountable transformer kit with 200-turn and 400-turn coils and a laminated iron core
- low-voltage a.c. supply, 2-12 V
- two a.c. voltmeters
- connecting leads

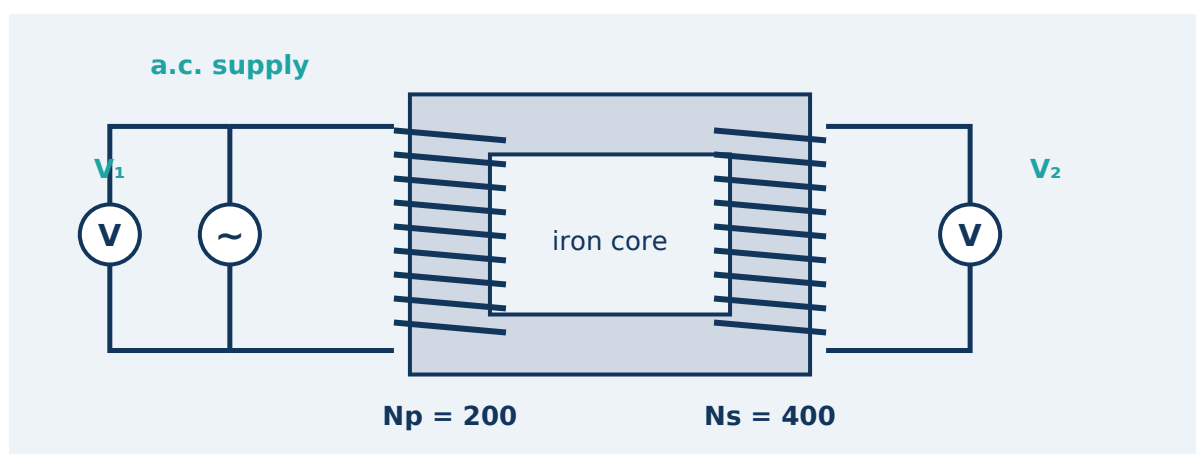
Safety

Safety

Use only the low-voltage a.c. supply and never connect the coils to the mains. Keep the primary below 12 V. Switch off between readings, because the coils can become warm.

Method

1. Fit the 200-turn coil (primary) and the 400-turn coil (secondary) on the core and clamp the top bar firmly.
2. Connect the supply and a voltmeter across the primary and a second voltmeter across the secondary, as shown.
3. Set the supply to 2.0 V a.c., switch on and read both voltmeters.
4. Record V_p and V_s , switch off and repeat for 4.0 V, 6.0 V, 8.0 V and 10.0 V.



Transformer: two coils on a laminated iron core. The primary coil is on the left, the secondary on the right.

Results

Sample readings from one group:

Primary voltage V_p (V)	Secondary voltage V_s (V)
2.0	3.8
4.0	7.7
6.0	11.5
8.0	15.3
10.0	19.0

Analysis questions

Question 1 Planning the readings

State which quantity you change, which you measure, and two things kept constant during the lab.

Question 2 Predicted value

Use the turns ratio to predict V_s when $V_p = 6.0$ V. Compare it with the measured value and calculate the percentage difference.

Question 3 Graph of V_s against V_p

Plot V_s on the y-axis against V_p on the x-axis and draw the best-fit line. Calculate its gradient using the first and last points.

Question 4 Ratio for each row

Calculate $V_s \div V_p$ for every row and find the mean. Compare it with the ideal value from the

turns and calculate the percentage difference.

Question 5 Why is V_s low?

Suggest two reasons why the measured secondary voltages are lower than the ideal values.

Question 6 Efficiency

With $V_p = 10.0$ V a lamp is connected to the secondary. The primary draws 0.65 A and the secondary supplies 0.30 A at 19.0 V. Calculate the efficiency.

Question 7 Making it more reliable

Suggest two changes that would make the results more reliable or the transformer more efficient.